notice. The classification of the ground-sloths is much more complicated than the one adopted by older writers, the Megalotheriidæ being now split up into a number of family groups. Very noteworthy is the inclusion among the Monotremata of an extinct South American family, the Dideilotheriidæ, with four generic modifications, as if this be justified it has a most important bearing on former land connections between the southern continents. We confess, however, to a certain amount of hesitation in accepting the determination of these South American fossils until it has been confirmed by a palæontologist of unquestioned authority. In retaining provisionally the South African Tritylodon among the mammalia, Dr. Trouessart is in accord with opinions lately expressed by Dr. R. Broom. R. L.

*How to Know Wild Fruits: a Guide to Plants when not in Flower by Means of Fruit and Leaf.* By Maude Gridley Peterson. Pp. xliii+340; illustrated. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) Price 6*s.* 6*d.* net.

"YE shall know them by their fruits" might well have served as the fore-word to this little volume. It deals only "with those plants which bear attractively coloured fruits," and might, therefore, be classed by the reviewer among that very large class of books which are made to look at rather than for any more serious purpose. The very first chapter, on "Adaptations of Fruits and Seeds for Dispersal and Protection," serves to dispel that notion. It consists only of some half-dozen pages, but those pages are instructive, and, better still, suggestive. Then comes a list of "definitions," few in number, but adequate to a book of these pretensions, especially as it is supplemented by a glossary at the end. "A Guide to the Plant Families Represented" comes next in order, and consists of an analytical table by means of which the several families may be discriminated by the observation of the variations in the character of their fruits. This seems to be carefully compiled, and is, so far as we have seen, accurate, but its value can only be tested by actual use in the field.

In the second table the families and species are grouped according to the colour of their fruits. Thus the monocotyledonous families are arranged according as the colour of the fruits is red, reddish-purple, green, black, or dark-purple, or blue. Of course, this is a highly artificial mode of grouping and one subject to exception, but if these circumstances be borne in mind the table will be found useful.

Coming now to the individual plants, which are all North American, the author gives a pretty full description of each, beginning with the fruit and passing on to the foliage and flowers. These descriptions might have been materially abridged and comparison rendered easier by the omission of unnecessary particles and verbs. In this matter the example of the author's fellow-countryman, Asa Gray, might have been followed. Moreover, they are not always botanically accurate; the "fruit" of the yew, for instance, is only remotely "drupe-like," and is certainly not a "drupe," as it is said to be in the same paragraph. Conversely, the leaves of the yew are really spirally arranged, but appear to be disposed in two planes only.

It would obviously be unfair to treat this book as if it were intended as a botanical text-book, but as a help to the beginner and a means of stimulating observation it may be commended. It is well got up, remarkably free from misprints, appropriately illustrated, and provided with an index of vernacular names and one of the Latin designations of the plants described.

## LETTERS TO THE EDITOR.

*[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.]*

### The Kangra Earthquake of April 4, 1905.

THERE have been certain papers on Indian geological questions recently published in the *Neues Jahrbuch* and associated *Centralblatt für Mineralogie, Geol. und Pal.* (Stuttgart), in which either the data or the deductions, generally both, have been unsound. In most cases the authorship alone has been sufficient to enable us to separate those papers that are worth careful study from those that are not even worth the time necessary to read. But in the latest production one of the editors of the journal appears as a joint-author, and one wonders consequently whether the papers we have been discarding in India as untrustworthy are, after all, normal or accessory constituents of a periodical which all geologists have regarded hitherto as essential to a working library.

The paper I now refer to appeared in the *Centralblatt* No. 11 (June), entitled "Das Erdbeben im Kangra-Tal (Himalaya) von 4 April 1905," by E. Koken and F. Noetling. The authors take eight pages of text and a map to demonstrate the unusual features of scientific interest shown by the recent earthquake—the time of its occurrence, the remarkable variation in the rate of transmission of the earthquake waves in different directions, the peculiar distribution of the isoseismal lines, and the exceptional shape of the meizoseismal area. The whole of this "scientific" discussion is built on a few newspaper cuttings, in the collection of which the authors have not been sufficiently industrious to escape certain tell-tale misprints which appeared only in the newspapers of the Presidency farthest removed from the earthquake centre. One example will be sufficient to illustrate the care exercised in collecting and checking their data.

The authors on p. 336 refer to a town named Tagarmalli as only very slightly damaged, and they consequently adopt this point, which they determine to be fifty miles from the epicentre, as the maximum extension eastwards of the meizoseismal area. As a matter of fact, no such place as Tagarmalli exists, and no such name appears in any of the gazetteers of India; the most casual attempt at verification would have shown the authors that they were basing their elaborate deductions on a misprint which appeared in one newspaper only. In one of the Lahore papers the names of the two places Nagar and Manali, twelve miles distant from one another in the Kulu valley, became contracted by the printer's devil to Nagarmalli, and in this form it was telegraphed to Bombay (*Times of India*, April 14) and to Calcutta (*Englishman*, April 14); but by the accidental omission of a single Morse's dot the word reached Madras as Tagarmalli (*Madras Mail*, April 15, and telegraphic summary, April 14). Having found the clue to the authors' source of data, we find it easy to explain other equally remarkable statements in the paper. In an earlier part of their paper (p. 334) they refer to the complete destruction of the place Nagar (Naggar), without suspecting that it was one of the roots of their mythical Tagarmalli; but on this occasion they have removed the little capital town of Kulu, and, for purposes of seismological reasoning, have carried it over the snowy range into the Kangra valley. To base a series of scientific deductions on a few newspaper cuttings may satisfy the devotee of precision (*alias* accuracy) in Germany, but to neglect the simple means of verifying their facts provided by the splendid maps of the Punjab, the complete gazetteers, or even the fourpenny postal guide obtainable in nearly every village, shows a carelessness that deserves the contempt of every scientific man.

But, after all, it is not the basis of data so much that is at fault, though even the purchase of a few more newspapers would have saved the authors from most of their pitfalls; it is the "scientific" superstructure that is so discreditable. When the authors noticed that the earthquake was recorded by the Bombay seismograph at

5·45 a.m., although the shock started from the focus, 1280 kilometres away, at 6.10, they examined their data with due scientific caution, and so discovered that the local time-standard of Bombay accounted for the apparently negative result; but as they obtained from their newspaper a positive record for the Calcutta seismograph, the application of the same system of scientific criticism of the time-standards did not occur to them. As a consequence, they arrive at the astonishing result that, whilst the earthquake waves travelling southwards to Bombay had a speed of 4·266 kilometres a second, those which were transmitted south-eastwards had a speed of 0·700 kilometres only.

The rest of the paper consists of "facts" and "inferences" of this kind, and whilst most are unimportant, it is desirable, perhaps, to point out that the epicentre determined by the authors is far removed from the true one. They have had to stretch their epicentre for more than forty miles to the west to account for the "complete destruction" of Pathankot. I was at Pathankot soon after the earthquake, and found it difficult to discover even a masonry crack in the town; even a few more newspaper cuttings would have shown the authors that the place was practically undamaged.

After picking a few pebbles out of this conglomerate of truth and fiction, one wonders why the paper was ever published at all. The very newspaper from which they obtained their data must have informed the authors that a thorough investigation of the earthquake had been organised by the Geological Survey. As both authors were in Madras at the time, one would imagine that a subject sufficiently interesting for a serious paper in a leading scientific journal would be worth, at any rate, a few more newspaper cuttings, even if a personal visit to the affected area were thought to be, for private reasons, inconvenient. We take it for granted that the long experience of both authors must have brought them into contact with the etiquette observed by scientific men, and that neither would consciously risk the recognised danger of forestalling the results of a thorough investigation by the publication of conclusions obtained from unverified data. But whatever the object, if the editor of a leading scientific journal can join in the production of such a paper, the future of scientific literature in Germany may yet give us entertainments as surprising as any of the recent efforts of the Russian Navy.

Of the Kangra earthquake, as well as of the other Indian questions which have been treated recently in the *Centralblatt* with an equal regard for accuracy, those who wish to know the truth will be provided with details in due season. Within a few days after the disaster occurred, every telegraph operator, meteorological observer, and district official north of the latitude of Bombay was provided with a complete guide for reporting the resulting phenomena, and the reports so obtained have since been supplemented by a detailed examination of the affected area by five officers of the Geological Survey. The observations made will be summarised first in the next part of the records, and the full details will form a special memoir, now in course of preparation. When these reports are ready, it will be seen that the actual facts, though in ways interesting and novel are scarcely so strange as German fiction.

T. H. HOLLAND.

Calcutta, July 20.

### The Transverse Momentum of an Electron.

WHEN Newton's third law is applied to an electron, it makes

$$\mathbf{F}=\dot{\mathbf{M}}+\dot{\mathbf{N}}, \qquad (1)$$

where $\mathbf{M}$ is the "momentum" in the field, or that part of the time integral of the force on the ether which is in the field, or $\Sigma\,\mathrm{V}\mathbf{DB}$, and $\mathbf{N}$ is the momentum already wasted, whilst $\mathbf{F}$ is the applied force on the electron. Similarly, Newton's fourth law (or the Scholium to the third) makes

$$\mathbf{Fu}=\dot{\mathrm{U}}+\dot{\mathrm{T}}+\mathrm{W}, \qquad (2)$$

if $\mathbf{u}$ is the velocity of the electron, U the electric and T the magnetic field energy, and W the rate of waste of energy.

Now, both W and $\dot{\mathbf{N}}$ are known in terms of the velocity and acceleration of the charge at any moment by formulæ I gave in NATURE, October 30, November 6, 1902. But when applied to (1), (2), these equations do not let us determine $\mathbf{M}$ generally in terms of the velocity and acceleration, on account of the variability of the state of the field, and the waste of energy and momentum. $\mathbf{M}$ is indefinite. But in long-continued forced circular motion of a charge, $\dot{\mathrm{U}}+\dot{\mathrm{T}}=0$. So

$$\mathbf{Fu}=\mathrm{W}=\mu\mathrm{Q}^2a^2/6\pi v\kappa \qquad (3)$$

(*loc. cit.*), where Q is the charge, and $a$ the acceleration (or $u^2/\mathrm{R}$, if R is the radius of the orbit). Also, $\kappa^2=1-u^2/v^2$. The direct or $\mathbf{u}$ component of $\mathbf{F}$ is therefore known. We also have (*loc. cit.*)

$$\dot{\mathbf{N}}=(\mathbf{u}/v^2)\mathrm{W}. \qquad (4)$$

Using this in (1), along with (3), we come to

$$\kappa^2\mathbf{F}_1=\dot{\mathbf{M}}_1, \qquad \mathbf{F}_2=\dot{\mathbf{M}}_2, \qquad (5)$$

where $\mathbf{F}_1$ is the $\mathbf{u}$ component, and $\mathbf{F}_2$ the transverse component, towards the centre.

Thus only the part $\kappa^2\mathbf{F}_1$ of the direct force is associated with the transverse or centripetal force $\mathbf{F}_2$ in keeping up the revolving state, the rest of $\mathbf{F}_1$, that is, $(u^2/v^2)\mathbf{F}_1$, being the wasted part as regards momentum, although the whole of $\mathbf{F}_1$ is concerned in the waste of energy.

Now, $\dot{\mathbf{M}}=\mathrm{V}\mathbf{nM}$, if $\mathbf{n}$ is the angular velocity. That is,

$$\dot{\mathbf{M}}=\dot{\mathrm{M}}_1\mathbf{u}_1+\mathrm{M}_1\dot{\mathbf{u}}_1+\dot{\mathrm{M}}_2\mathbf{a}_1+\mathrm{M}_2\dot{\mathbf{a}}_2, \qquad (6)$$

if $\mathbf{u}_1$ and $\mathbf{a}_1$ are unit vectors, making

$$\dot{\mathbf{u}}_1=(u/\mathrm{R})\mathbf{a}_1, \qquad \dot{\mathbf{a}}_1=-(u/\mathrm{R})\mathbf{u}_1. \qquad (7)$$

Also $\dot{\mathrm{M}}_1=0$, $\dot{\mathrm{M}}_2=0$, because the motion is steady. So we convert (5) to

$$\kappa^2\mathbf{F}_1=\dot{\mathbf{M}}_1=-\mathrm{M}_2(u/\mathrm{R})\mathbf{u}_1, \quad \mathbf{F}_2=\dot{\mathbf{M}}_2=\mathrm{M}_1(u/\mathrm{R})\mathbf{a}_1. \quad (8)$$

Finally, although we get no formula for $\mathrm{M}_1$, we do obtain a complete formula for $\mathrm{M}_2$, viz.,

$$\mathrm{M}_2=-\mu\mathrm{Q}^2a/6\pi v\kappa^2. \qquad (9)$$

This is the transverse momentum of Q in steady circular motion, without any limitations upon the size of the velocity and acceleration, save the usual ones, $u<v$, and $a$ not excessively great in regard to the diameter of the electron.

It would seem that an integration over the whole field, in which $\mathbf{E}$ and $\mathbf{H}$ are known (*loc. cit.*), is required to find $\mathbf{M}_1$, the direct momentum. If, however, the acceleration is infinitesimal, the known formula for $\mathrm{M}_1$ in steady rectilinear motion may be employed, viz. $\frac{1}{2}\mathrm{M}_1u=\mathrm{T}$.

Finally, I have pleasure in saying that Mr. G. F. C. Searle, F.R.S., led me to see that my waste formulæ led to the formula (9) for the transverse momentum, by submitting to me a calculation of $\mathrm{M}_2$ in the special case of infinitesimal acceleration and velocity. He made no use of the waste formula, not being aware of it, but, since in the circumstances the waste is infinitesimal, it did not matter. In fact, $\frac{1}{2}\mathrm{M}_1u=\mathrm{T}$ leads to the reduced special value of the transverse momentum when $u$ and $a$ are infinitesimal. The argument became somewhat obscure by the want of comprehensiveness, but the result agrees with (9).

OLIVER HEAVISIDE.

August 20.

### A Parasite of the House-fly.

I SHOULD be very glad if Mr. Hill (p. 397) would send me a few specimens of the *Pseudoscorpiones* he has found attached to common house-flies, and I will endeavour to identify them for him. There are several genera of this order represented in the British fauna, and it is probable that all the species occasionally attach themselves to the legs or wings of larger insects and arachnids. There is some doubt, however, whether this is a case of true parasitism. It may be that the occasional association of these small arachnids with larger and more rapid arthropods is of importance to the species in providing a means for a wider geographical distribution.

SYDNEY J. HICKSON.

The University, Manchester, August 25.